



**US Army Corps
of Engineers** ®
San Francisco District

Redwood City Harbor, California, Navigation Improvement Feasibility Study

Appendix B

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1. Purpose of Report

This report summarizes the utility survey, the Redwood City Harbor and San Bruno Shoal Channel design criteria and the dredged material placement site required to support the planning and Federal interest determination of a civil works navigation project in the Redwood City Harbor Channel and San Bruno Shoal Channel. This project is referred to as the “Redwood City Harbor, California, Navigation Improvement Feasibility Study”, or more generically as the “study” or “study area” in this report. This report will serve as an appendix to the study’s integrated feasibility study and environmental impact statement report.

2. Background

The study area is Redwood City Harbor, which is located in San Mateo County, California, on the southwest side of San Francisco Bay, approximately 18 miles south of San Francisco, California. The study area includes two existing navigation channels: the Redwood City Harbor Channel and San Bruno Shoal Channel (Figure 1). The Redwood City Harbor Channel extends from the mouth of Redwood Creek to deep water in the San Francisco Bay, while the San Bruno Shoal Channel is located in San Francisco Bay. Both channels are maintained at -30 ft mean lower low water (MLLW) with 2 ft of allowable over depth. The tentatively selected plan was to deepen both channels to -32 ft MLLW and to transport and dispose the dredged material at the San Francisco Ocean Disposal Site SF-DODS.

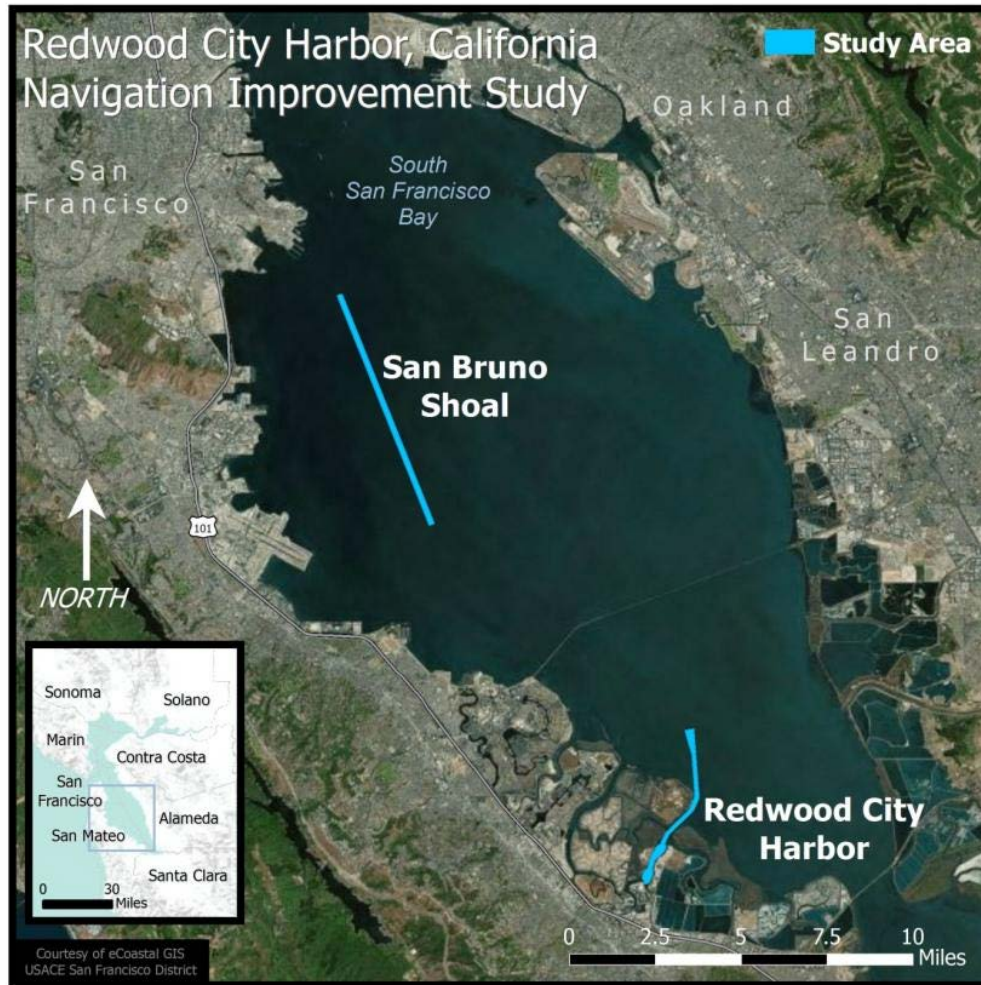


Figure 1. Study area

3. Dredge Quantities

The dredge quantities for both the Redwood City Harbor and San Bruno Shoal Channels were computed with Hypack. The dredge quantities for the Redwood City Harbor Channel are summarized in tables 1, 2 and 3 and the quantities for the San Bruno Shoal Channel are summarized in tables 4, 5 and 6.

Table 1, Redwood City Channel at -32 ft

Reach	Station	-32 ft (CY)	1 ft Overdepth (CY)	Total (CY)
1	0+00 to 42+00	34,221	22,402	56,622
2	42+00 to 84+00	102,156	46,913	149,069
3	84+00 to 126+00	137,899	61,783	199,683
4	126+00 to 168+00	378,149	76,273	454,422
5A	168+00 to 186+00	143,363	34,529	177,892
5B	186+00 to 208+49	197,808	57,132	254,940

	TOTAL	993,595	299,031	1,037,687
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Table 2, Redwood City Channel at -34 ft

Reach	Station	-34 ft (CY)	1 ft Overdepth (CY)	Total (CY)
1	0+00 to 42+00	86,890	36,068	122,958
2	42+00 to 84+00	201,548	56,040	257,588
3	84+00 to 126+00	260,221	68,880	329,101
4	126+00 to 168+00	523,400	77,340	600,740
5A	168+00 to 186+00	207,013	34,872	241,885
5B	186+00 to 208+49	304,251	57,145	361,397
	TOTAL	1,583,324	330,346	1,552,273

Table 3, Redwood City Channel at -37 ft

Reach	Station	-37 ft (CY)	1 ft Overdepth (CY)	Total (CY)
1	0+00 to 42+00	217,531	54,819	272,349
2	42+00 to 84+00	374,864	61,435	436,300
3	84+00 to 126+00	474,685	76,993	551,677
4	126+00 to 168+00	738,009	77,644	815,653
5A	168+00 to 186+00	301,582	34,911	336,492
5B	186+00 to 208+49	461,508	57,143	518,651
	TOTAL	2,568,178	362,945	2,931,122

Table 4, San Bruno Shoal Channel at -32 ft

-32 ft (CY)	1 ft Overdepth (CY)	Total (CY)
118,161	221,248	339,410

Table 5, San Bruno Shoal Channel at -34 ft

-34 ft (CY)	1 ft Overdepth (CY)	Total (CY)
701,134	492,075	1,193,209

Table 6, San Bruno Shoal Channel at -37 ft

-37 ft (CY)	1 ft Overdepth (CY)	Total (CY)
2,350,129	641,445	2,991,574

4. Utility Survey

Three pipelines run beneath San Bruno Shoal in San Francisco Bay. Two of the pipelines are owned by Kinder Morgan and one is owned by Shell. The USACE and Port of Redwood City did not have any documentation, pre-existing surveys, or other information that would indicate the depth of these pipelines. As a result, a water-based field reconnaissance survey was conducted in June 2014 with a STARFIX DGPS Satellite Navigation System, a single beam echo sounder, an edgetech DS 2000 Side Scan Sonar, sub-Bottom profiler systems and a magnetometer and a water-jet probing diver survey was conducted in October 2014 using divers and water-jet probes.

4.1. Water-Based Field Reconnaissance Survey

A Marine Magnetic Corporation SeaSPY marine magnetometer was deployed from the starboard stern of the survey vessel, and run in order to confirm man-made objects versus natural objects. Magnetic anomalies occur when the towed magnetometer sensor passes near an object containing iron. The size of the magnetic anomaly depends mostly on how close to the iron object the sensor is and the amount (mass) of iron. The size (intensity) of magnetic anomalies is expressed in gammas (or nanoteslas). Total field readings were logged to the acquisition computer through the SeaSPY's communications transceiver.

The results from the survey are summarized below in Table 1, Water Based Field Reconnaissance Survey Results.

Table 7, Water Based Field Reconnaissance Survey Results

Approximate Surveyed Project Stationing	Channel	Description	Owner	Depth of Burial	Bottom of Trench Elevation (MLLW) Range
38+00	San Bruno Shoal	10" and 12" Pipelines	Kinder Morgan	2.6' to 6.8'	-35.80 to -39.67
148+70	San Bruno Shoal	Non-Operational 10" Pipeline	Shell	3.7' to 6.2'	-34.11 to -36.63

The water based field reconnaissance survey was only able to detect a trench during the survey of the Kinder Morgan pipelines. The Kinder Morgan pipelines could not be detected during the water based field reconnaissance survey. As a result, the diver survey was conducted in order to determine the depth of the Kinder Morgan pipelines.

4.2. Water-Jet Probing Diver Survey

Four divers utilized a 1" jet probe to survey the Kinder Morgan pipelines on October 22, 2014. The results from the survey are summarized below in Table 2, Diver Survey Results.

Table 8, Diver Survey Results

Approximate Pipeline Station	Description of Activity	Results
1124+20	Eastern Limit of Channel	
1124+65	Probed approximately 10 to 15 feet north and south of pipeline alignments.	Armoring rock found 2 to 3 feet below mudline. Unable to penetrate rock.
1125+18	Probed approximately 10 to 15 feet north and south of pipeline alignments.	Armoring rock found 2 to 3 feet below mudline. Unable to penetrate rock.
1125+45	Probed approximately 23 feet north to end of armoring rock. Probed 10 feet south of pipeline alignments.	Armoring rock found 1 to 2 feet below mudline. Unable to penetrate rock.
1125+77	Probed approximately 20 feet north to end of armoring rock. Probed 10 feet south of pipeline alignments.	Armoring rock found 1 to 2 feet below mudline. Unable to penetrate rock.
1126+80	Channel Center Line	
1128+06	Probed Channel alignments. Touched pipelines.	Armoring rock detected. Pipelines found with 5 feet (plus or minus 2-3 inches) depth and 5 feet horizontal separation between pipelines.
1128+80	Probed Channel alignments. Touched pipelines.	Armoring rock detected. Pipelines found with 5 feet (plus or minus 2-3 inches) depth and 5 feet horizontal separation between pipelines.
1129+45	Western Limit of Channel	

5. Redwood City Harbor and San Bruno Shoal Channel

The Redwood City Harbor Channel is located in San Mateo County, California and extends from the mouth of the Redwood Creek to deep water in the San Francisco Bay (Attachment I). The San Bruno Shoal Channel is located in the San Francisco Bay (Attachment II). Bair and Greco Islands, part of the Don Edwards National Wildlife Refuge, are adjacent to the Redwood City Harbor.

In order to reduce the environmental impacts that the deepening project could have on the refuge, the Redwood City Harbor channel boundaries are different from the current authorized channel boundaries. The USACE coordinated with the San Francisco Bar Pilots regarding the channel boundary changes from the current authorized channel boundaries. From station 80+00 to station 122+00, the channel was realigned 6 feet away from Bair Island. From Station 127+00 to station 140+00, the channel was realigned 6 feet away from Greco Island. From station 140+00 to station 155+00, the channel was realigned 6 feet away from Bair Island. From station 155+00 to station 162+00, the channel width was reduced by 12 ft. From station 162+00 to the end of the turning basin, the channel width was reduced by 6 ft on the Bair Island side only.

A ship simulation study is required for the Redwood City Harbor Channel Deepening Project and it is normally conducted during the feasibility phase. However, the USACE and the Port of Redwood City made the decision to conduct the ship simulation study during the PED phase.

The Redwood City Harbor Channel and San Bruno Channel side slopes of 3H: 1V were determined appropriate for the feasibility phase. Soundings were taken by a fathometer and are based on the Mean Lower Low Water (MLLW) datum. The plane grids and coordinates are based on the Lambert projection, NAD 83 California Zone 3.

6. Montezuma Wetland Restoration Site

Montezuma Wetlands Restoration Project is a privately owned, ongoing restoration effort. Montezuma Wetland Restoration Project accepts both wetland cover and wetland non-cover (foundation) quality material from new work and maintenance projects. This site is currently accepting sediment and has an off-loader in place and operating. The project site comprises approximately 2,400 acres at the eastern edge of Suisun Marsh, approximately 17 miles southeast of Fairfield, California.

Ground elevations at the site have subsided up to 10 feet since its tidal marshlands were diked and drained for agricultural purposes more than 100 years ago. All site preparation, monitoring, and reporting is handled by the MWP, which charges a tipping fee for accepting dredged sediment. The tipping fee includes use of the offloader.

7. Cullinan Ranch Tidal Restoration Site

Cullinan Ranch Tidal Restoration Project is a permitted wetland restoration site that comprises more than 1,500 acres and is located in western Solano County near the city of Vallejo. It is located between State Highway 37 and Dutchman Slough. It is considered a beneficial reuse site and is currently permitted and available. Cullinan Ranch is a former hay/cattle farm that is being restored to tidal marsh. It has a total capacity of 3 million cubic yards of dredged sediment. The sediment will be used to raise up to 290 acres of the site to marsh plain elevation. The site has two locations, both located in Napa River, north and south of the mouth of Dutchman Slough, respectively. Both locations are accessible by large scows.

8. San Francisco Deep Ocean Disposal Site SF-DODS

SF-DODS is located in the Pacific Ocean, approximately 55 nautical miles west of the Golden Gate Bridge. The site is approximately 85 nautical miles from RWC Harbor and approximately

75 nautical miles from SBS channel. The site was established in 1994 by the Long Term Management Strategy agencies, and is managed by the EPA.

Dredged material is not allowed be leaked or spilled from the scows during transit to the SFDODS. Transportation of dredged material to the SF-DODS can only be allowed when weather and sea state conditions do not interfere with safe transportation and do not create risk of spillage, leak or other loss of dredged material in transit to the SF-DODS. No scow trips are allowed to be initiated when the National Weather Service has issued a gale warning for local waters during the time period necessary to complete dumping operations, or when wave heights are 16 feet or greater.

9. References

HDR, *Utility Survey for the Redwood City Deepening Project*. Prepared for the U.S. Army Corps of Engineers, San Francisco District. November, 2014.